UCRL-JC-123608 Abs

O3 and Stratospheric H2O Radiative Forcing Resulting From A Supersonic Jet Transport Emission Scenario

Allen S. Grossman, Douglas Kinnison, Joyce Penner,
Keith E. Grant, John Tamareses, Peter Connell

Atmospheric Science Research Division,
Lawrence Livermore National Laboratory
P.O. 808, L-262
Livermore, CA 94551

November 1995

The tropospheric radiative forcing has been calculated for ozone and water vapor perturbations caused by a realistic High Speed Civil Transport (HCST) aircraft emission scenario. Atmospheric profiles of water vapor and ozone were obtained using the LLNL 2-D chemical-radiative-transport model (CRT) of the global troposphere and stratosphere. IR radiative forcing calculations were made with the LLNL correlated k-distribution radiative transfer. UV-Visible-Near IR radiative forcing calculations were made with the LLNL two stream solar radiation model. For the case of water vapor the IR and Near IR radiative forcing was determined at five different latitudes and then averaged using an appropriate latitudinal average to obtain the global average value. Global average values of radiative forcing were appriximately 1.2 - 2.6 10-3 W/m2, depending on the background atmospheric water vapor profile. This result is consistant with prior published values for a similar aircraft scenario and supports the conclusion that the water vapor climate forcing effect is very small. The radiative forcing in the IR and UV-Visible spectral ranges, due to the ozone perturbation, was calculated for the globally averaged atmosphere. Global average values of the radiative forcing were 0.034 W/m2 for the UV-Visible spectral range and 0.006 W/m2 for the IR spectral range (0.04 W/m2 total) were obtained. This result is also consistant with the range of published values obtained for a similar HSCT scenario. As was the case for water vapor, the ozone forcing is too small to be of major consequence.

Work performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore National Laboratory under contract No. W-7405-Eng-48.